The enormous distinction between animals and plants regarding the problems under discussion is brought about primarily by the fact that in plants *the asexual generation* has undergone increased evolution, in animals *the sexual generation*. I might, indeed, have cited the peach tree, quoted by Prof. Dendy, instead of the chrysanthemum. Peach trees, as anyone who tends a garden knows, are reproduced *asexually by grafts*, and not *sexually* from seed, as Prof. Dendy assumes. The reason is simply that peach trees do not "come true" from seed. Probably the evergreen condition would not be repeated from seed. Coming true in grafts, this is a good example of my contentions.

A true theory of heredity, like the mnemic one, must be founded in a correct embryology, and this theory of Hering's is the sole one which can be shown to conform with the facts of the cycle of animal life. All other theories known to me are based in direct development—an impossibility. In developmental researches, which extend back so far as 1888, antithetic alternation of generations has proved itself to be the only possible mode of animal development. Moreover, this is in accord with Pasteur's fundamental researches establishing the stereochemistry of naturally occurring organic compounds. Those who with Weismann and Haeckel hold to direct development, or any theories of heredity based on this, live in a universe in which there is no science of stereochemistry, and in which the naturally occurring organic compounds have no action upon the plane of polarised light.

Nor do identical twins arise as Weismann supposed. The whole "evolution theory" of Weismann is full of such baseless hypotheses. If ordinary identical twins (AB, AB) arise so, how do the rarer ones (AB, BA), where the one is the looking-glass image of the other, externally and internally, come about? Or how are identical triplets produced, or the seven to twelve identical embryos from a single egg in the seven-banded armadillo, *Praopus hybridus?* Embryo or sexual generation does not, as is so generally believed, ever arise by the first few divisions of the egg. The facts and reasons contained in this and my former letter—though they do not profess to be all the pertinent facts—may serve to indicate why a correct appreciation of the cycle of animal life is so important for all theories of heredity, and, one might also add, for all theories of the origin and nature of cancer. For under current false theories of development cancer is "an incurable disease," whereas in the light of a true embryology and in that of stereochemistry it is *a natural phenomenon*, which Nature has demolished for untold millions of years, and which man also can cope with and destroy whenever he sees fit to imitate her and to use her methods. J. BEARD.

8 Barnton Terrace, Edinburgh, February 15.

(1) I QUITE agree with Dr. Reid that the mnemic hypothesis does not demonstrate the transmission of acquirements. What I said in my review was that the mnemic theory is based upon a belief in the inheritance of acquired characters—a statement that anyone may verify who will take the trouble to read Prof. Semon's book. I should perhaps have qualified the statement by saying "Prof. Semon's Mnemic Theory," though personally I cannot conceive of a mnemic theory which is not so based.

The inheritance or non-inheritance of acquired characters is, of course, still an open question, but it is interesting to reflect that such inheritance was assumed as a matter of course by the great founders of the theory of organic evolution—Buffon, Erasmus Darwin, Lamarck, and Charles Darwin—and was never called in question until the latter part of the nineteenth century. Before that time no one thought it necessary to make experiments to prove or disprove what everybody believed; since then there has not been time to make anything like enough experiments, but some of those which have been made certainly seem to indicate the possibility of the inheritance of acquired characters in the strictest sense of the term. It is not a question which can be answered dogmatically or by any amount of *a priori* argument. It was just as reasonable for Lamarck and others to suppose that such characters can be inherited as it is for Weismann and his followers to suppose that they cannot. Let us wait and see what the future may bring forth.

(2) IF Dr. Beard will read the review which gave occasion for his first letter, he will find it plainly stated that the peach trees in Bordage's experiments were raised from seeds. Had they been raised in the ordinary way from grafts there would, of course, have been no point in the observations, and I certainly should not have thought it worth while to direct attention to them.

I suppose all upholders of the mnemic theory will agree that if the germ-cells could not remember events in the past history of the race, no developmental unfolding would be possible. The important point seems to be that the events in question have, for the most part at any rate, been experienced by the body and not by the germ-cells, and that unless the germ-cells received information of them from the body they could not remember them at all. This view necessarily assumes that the body is able to transmit impressions to the germ-cells, which, as I said before, is the fundamental idea of the doctrine of the inheritance of acquired characters. The experiences of the body are supposed to depend, in the first instance at any rate, upon the environment, and to give rise to "acquired" characters, and such characters, according to the mnemic theory, influence the germ-cells and are transmitted by them to the bodies of future generations.

I do not propose to discuss Dr. Beard's views on animal development, but I think it ought to be clearly stated that the mnemic theory, as ordinarily understood, is entirely independent of any such views. If Dr. Beard has a mnemic theory of his own that is another matter, but it might be well to call it by some other name.

ARTHUR DENDY.

How Pollen is Collected by the Honey-bee.

ON February 11, a mild and sunny day, my bees were working busily on *Eranthis hiemalis*, the winter aconite, and by watching them I was able to verify my opinion, published in *The British Bee Journal* of December 14, 1911, that the pollen is collected by being scraped into the fissure between the tibia and metatarsus, and is compressed and forced out into the "corbicula," or pollen-basket, on the outside of the tibia by the closing of the fissure, a conclusion suggested by the examination of the hind leg of a queen humble-bee.

One bee was watched for more than five minutes rifling flower after flower. During this time the load of pollen in each corbicula increased in size considerably, but the bee did not once cross its legs and scrape the pollen-laden metatarsal brushes on the upper edges of the opposite tibiæ, which was the way that Cheshire supposed the corbicula was loaded ("Bees and Bee-keeping," vol. i., p. 132). On the other hand, the inner sides of the metatarsi were frequently rubbed together, *the motion being longitudinal*, and it was evidently by this rubbing or scraping that the corbiculæ were loaded, for the hind legs did not come into contact with one another in any other way.

Several other bees were watched, and were found to behave in exactly the same manner. In all cases the pollen was gathered on to the metatarsal brushes direct from the anthers as the result of the bee crawling about amongst the stamens.

My observations were hampered by a gusty wind, which disconcerted the bees, and they were soon brought to a close by the sunshine passing off the flowers, so that several points that I had hoped to clear up still remain obscure.

One of these is the way in which the pollen dust is moistened with nectar. The only satisfactory manner in which, it seems to me, this can be done is for the tongue to lick the tarsi or metatarsi of the fore legs, which are covered with stiff bristles well suited for holding the nectar, the nectar being then transferred to the metatarsal brushes on the middle legs, and from these, again, to the metatarsal brushes on the hind legs. The latter being thus rendered sticky, the pollen dust would cling to them. The different pairs of legs were certainly brought together occasionally, but not after every scrape of the hind metatarsi, and their movements were so quick that it was impossible to see what was done. Still, several pollen-collecting bees that I killed had the tarsi and metatarsi of the fore legs and the metatarsal brushes of the middle and hind legs moistened with nectar, and I think it probable

© 1912 Nature Publishing Group

that the moistening process, as outlined, is performed, as a rule, during the flight from flower to flower. Indeed, upon reflection, one feels convinced that this would be the most convenient interval in the ceaseless work of the proverbially busy bee for performing this function, while at the same time the instinct to do it then, once acquired, would ensure its accomplishment when and as often as necessary. I intend to dust with flour the hind metatarsi of bees entering flowers, and also those of bees leaving flowers. If the former retain more flour than the latter, the theory that the moistening takes place during the flight from flower to flower will be demonstrated.

Probably the kinematograph will be able before long to reproduce the whole process of pollen-collecting at a speed slow enough to be followed by the human eye.

Ripple, Dover. F. W. L. SLADEN.

Microscope Stands.

MR. J. W. OGILVY, in his reply (NATURE, February 8) to one of my questions, does little more than reiterate his former statement that the German instruments are superior, and are produced in better organised works. This seems to introduce the question of workmanship, which has not, to my knowledge, been brought under consideration. The discussion seems to be one of design.

Mr. Ogilvy also appeals for proof of superiority to the number of Continental instruments in the various technical laboratories. Even if the number in use is larger, this cannot be accepted as proof of their superiority. The number of chromatic "Abbe" condensers must be much larger than of other condensers, but this does not prove that it is the best condenser. I do not think it has been proved that the most intelligent users are to be found in the various technical laboratories. The last paragraph of "F.R.M.S.'s" letter is proof of what I mean.

Now, with regard to the sprung fittings, Mr. E. M. Nelson, writing in the current issue of *The English Mechanic*, says:—"I have always considered springing to be a most important point in microscope construction."

The question seems to be this: "Which instrument, the English or the Continental, is, by virtue of its design and workmanship combined, capable of affording the scientific worker the greatest facilities for work of a critical character?"

I venture to think that the answer to this question by our most eminent workers would not be so much in favour of the Continental type as Mr. Ogilvy seems to imagine.

Boston Spa, near Leeds. JOHN A. L. SUTCLIFFE.

As the writer of a letter on "Microscope Stands" in NATURE of February 22, I wish to add that the term "Continental firm" used in connection with the remarks on horseshoe base with extended rear toe, mechanical stage on a rotating principle, and machined slide bearings should include the American manufacturer.

F. R. BRAND.

Meteor-showers.

THE following meteor-showers become due in March; their arrangement is according to the principal maxima:—

Epoch March 1, 12h. (G.M.T.), fifth order of magnitude. Principal maximum, March 2, 13h. 5m.; secondary maximum, March 1, 9h. 30m.

Epoch March 5, 20h. 30m., eighteenth order of magnitude. Principal maximum, March 4, 12h. 35m.; secondary maxima, March 4, 9h. 30m. and 19h. 35m.

Epoch March 5, 21h., twenty-fifth order of magnitude. Principal maximum, March 6, 7h.; secondary maximum, March 5, 0h. 30m.

Epoch March 9, 22h. 30m., twenty-second order of magnitude. Principal maximum, March 8, 20h. 45m.; secondary maximum, March 8, 3h. 30m.

Epoch March 9, 3h. 30m., ninth order of magnitude. Principal maximum, March 9, 19h. 50m.; secondary maximum, March 9, 20h. 40m.

Epoch March 11, 8h. 30m., first order of magnitude. Principal maximum, March 10, 23h. 10m.; secondary maxima, March 10, 0h. 5m. and 16h. 50m.

Epoch March 12, 13h., ninth order of magnitude. Principal maximum, March 12, 12h. 50m.; secondary maximum, March 11, 13h. 40m.

Epoch March 13, 16h., twentieth order of magnitude. Principal maximum, March 13, 1h.; secondary maximum, March 12, 8h. 50m.

Epoch March 19, 22h., tenth order of magnitude. Principal maximum, March 18, 17h. 45m.; secondary maximum, March 18, 9h. 10m.

Epoch March 21, 10h., eighteenth order of magnitude. Principal maximum, March 19, 14h. 30m.; secondary maxima, March 17, 19h. 25m., and March 18, 4h. 30m.

Epoch March 19, 2h., approximately second order of magnitude. Principal maximum, March 20, 15h.; secondary maxima, March 19, 6h. 50m., and March 22, 10h. 50m.

Epoch March 22, 2h. 30m., tenth order of magnitude. Principal maximum, March 22, 3h. 20m.; secondary maxima, March 23, 16h. 25m. and 22h. 45m.

Epoch March 23, 21h., thirtieth order of magnitude. Principal maximum, March 24, 17h. 30m.; secondary maximum, March 26, 12h. 55m.

Epoch March 26, 14h., eighteenth order of magnitude. Principal maximum, March 26, 5h. 40m.; secondary maxima, March 26, 2h. 20m. and 11h. 30m.

Epoch March 27, 14h. 30m., twentieth order of magnitude. Principal maximum, March 27, 10h.; secondary maximum, March 27, 4h.

Epoch March 27, 4h. 30m., approximately first order of magnitude. Principal maximum, March 28, 22h. 45m.; secondary maxima, March 27, 12h. 10m., and March 28, 6h.

Though meteor-displays are distributed, apparently, pretty evenly over the month, yet there are periods of special intensity. These periods, which are four in number, comprise the dates March 2–4, March 9–13, March 20–22, and March 26–28. Heavy meteor-falls are due on the nights of March 2 and 4.

Dublin. JOHN R. HENRY.

EXAMINATIONS IN SECONDARY SCHOOLS.[1]

THE Consultative Committee of the Board of Education has, for the second time, made a report on examinations in secondary schools, and, though opinions may differ as to the precise value of the recommendations which the committee now makes, everyone must congratulate the members on the valuable information they have collected and the clearness with which they have shown once more the existence of a great evil, and the arguments for and against various methods of dealing with it. The report which the committee made seven years ago has been followed by a small improvement, but secondary education in this country still groans under the burden of a needlessly complicated system of examinations, which are the cause of the gravest injury, not only to secondary schools, but to all branches of higher education which depend so largely on the foundation laid in these schools.

One of the saddest points brought out in the report is the extent to which young children are at present submitted for examinations, notwithstanding the efforts of the Board of Education and certain local education authorities to prevent this. Thus a return supplied by the Lancashire Education Committee shows that nearly half of 1070 pupils of certain schools in the county submitted for external examinations during a given year were below the age of sixteen. Unfortunately, the ancient Universities of Oxford and Cambridge are amongst the greatest offenders in the matter of providing such examinations, for it appears that in their local examinations alone more than 20,000 children under sixteen were examined in 1908.

It is shown that the results of these examinations are largely used, more particularly by inferior schools, as a means of advertisement, and that this system is aided by the ancient universities by an arrangement

---

[1] Report of the Consultative Committee of the Board of Education on Examinations in Secondary Schools. Cd. 6004. (Wyman and Sons.) Price 2*s*. 6*d*.

© 1912 Nature Publishing Group